

## **REMARKS**

### **I. Introduction**

In response to the Office Action dated November 28, 2007, Applicants have amended claims 5, 9 and 13 in order to further clarify the present invention. Support for the amendments may be found, for example, in paragraphs [0056], [0072] and [0097] of the Specification. In addition, claims 1-4 have been cancelled, without prejudice. No new matter has been added.

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

### **II. The Rejection Of Claims 1-3, 5-6, 13 And 15 Under 35 U.S.C. § 102**

Claims 1-3, 5-6, 13 and 15 were rejected under 35 U.S.C. § 102(b) as being anticipated by Keys (US 2004/0235280). Applicants respectfully submit that Keys fails to anticipate the pending claims for at least the following reasons.

With regard to the present invention, amended claims 5 and 13 each disclose, in-part, a method for manufacturing a semiconductor device that comprises the successive steps of: (a) forming an amorphous layer; (b) heat treating the amorphous layer without implanting ions into the amorphous layer, thereby reducing the depth of the amorphous layer; and (c) after the heat treating step, introducing an ion impurity into the heat-treated amorphous layer.

One feature of claims 5 and 13 is that in step (b) the amorphous layer shrinks to a shallower depth in the substrate (a second depth) with the defects that are generated in the step (a) of forming the amorphous layer remaining at the deeper depth (first depth) in the substrate. Thus, a source/drain region is formed without the negative effects existing in the first depth by

implanting an impurity in the amorphous layer at the second depth. As a result of this feature, a transistor having reduced leakage current caused by defects can be obtained.

In contrast to the present invention, Keys fails to recite the method of claims 5 and 13 disclosed above. Keys discloses a method for manufacturing a semiconductor device, comprising the steps of: forming an amorphous layer, *implanting recrystallization inhibitor ions*, and then heat treating to reduce a depth of the amorphous layer, and then implanting an impurity into the depth-reduced amorphous layer. Thus, Keys discloses implanting recrystallization inhibitor ions such as nitrogen, fluorine or oxygen into the formed amorphous layer. For example, Keys teaches in paragraph [0026] an implantation dose of  $1 \times 10^{12}$  to  $1 \times 10^{18}$  atoms/cm<sup>2</sup>, which is equivalent to the dose amount of a general impurity in an extension region, which is  $1 \times 10^{14}$ . Thus, the recrystallization inhibitor ions of Keys may cause bad effects in doping of a p-type and an n-type impurity which are generally necessary to produce a semiconductor device.

Accordingly, the method of Keys is different from that of claims 5 and 13 of the present invention, in which the step of implanting recrystallization inhibitor ions is not performed. As a result, Keys method would not prevent the occurrence of defects resulting from the implantation of recrystallization inhibitor ions which accordingly cause the transistors to deteriorate.

Anticipation under 35 U.S.C. § 102 requires that each and every element of the claim be disclosed, either expressly or inherently in a prior art reference, *Akzo N.V. v. U.S. Int'l Trade Commission*, 808 F.2d 1471 (Fed. Cir. 1986). At a minimum, Keys does not disclose forming an amorphous layer in a region from a surface of a semiconductor region of a first conductivity type to a first depth; by heat treating the amorphous layer at a prescribed temperature without

implanting ions into the amorphous layer, restoring a crystal structure of the amorphous layer in a region from the first depth to a second depth that is shallower than the first depth so that the amorphous layer shrinks to the second depth. Therefore, as it is apparent from the foregoing that Keys fails to anticipate amended claims 5 and 13 or any dependent claims thereon, Applicants respectfully request that the § 102 rejection be traversed.

Furthermore, as Keys teaches the implantation of recrystallization inhibitor ions, and the present invention performs a heat treatment without implanting such ions, Keys teaches away from the present invention.

### **III. The Rejection Of Claims 9-11 Under 35 U.S.C. § 103**

Claims 9-11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yu (USP No. 6,521,502) in view of Keys (US 2004/0235280). Applicants respectfully traverse this rejection of the pending claims for at least the following reasons.

As in claims 5 and 13 discussed above, amended claim 9 of the present invention also recites a method for manufacturing a semiconductor device that comprises the successive steps of: (a) forming an amorphous layer; (b) heat treating the amorphous layer without implanting ion into the amorphous layer, thereby reducing the depth of the amorphous layer; and (c) after the heat treating step, introducing an ion impurity into the heat-treated amorphous layer.

As it has been shown above that Keys does not teach the same order of the above cited steps, and that the difference in order of steps results in unexpected and superior results, and as Yu is not relied upon to remedy this deficiency, the combination of Yu and Keys does not render claim 9 obvious. Accordingly, Applicants respectfully request that the § 103 rejection of claim 9 be withdrawn.

**IV. All Dependent Claims Are Allowable Because The Independent Claim From Which They Depend Is Allowable**

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 5, 9 and 13 are patentable for the reasons set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance.

**V. Conclusion**

Having responded to all open issues set forth in the Office Action, it is respectfully submitted that all claims are in condition for allowance.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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